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Title: **A UV Fluorescence Bio-detector that works; Reminiscing about the >12 km LANL Bio-Lidar System**

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A UV Fluorescence Bio-detector that works; Reminiscing about the >12 km LANL Bio-Lidar System @ 200 ACPLA

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Description: Sixteen years ago US army ERDEC had the Los Alamos National Laboratory build and operate a portable ultraviolet Lidar for the detection of biological simulants. We were directed to choose a laser that could excite the peak absorption for most simulants in the vicinity of 275 nm. A survey revealed that the lasers available were very complex and of low reliability with low pulse energy from inefficient multi-step conversion systems in the 260- 280 nm region. We realized that signal averaging could not overcome the small signals from low laser energies, and more alarmingly the strong ozone attenuation of the atmosphere would limit any operation to very short ranges. We chose to move to longer wavelengths away from the ozone darkening region and found the very high energy, high efficiency, and simple to operate 800 mJ 200 Hz XeCl Excimer laser. The 307 nm laser wavelength was strongly absorbed by the simulants without photo induced dissociation, and therefore gave very high fluorescent efficiencies and range capabilities over 10 km from a single shot.

Results: This system was field tested at Los Alamos in the summer of 1986 on the lowest concentrations of BG that Dugway could produce, with immediate excellent results. In 23 other tests this portable system proved to be a very sensitive and reliable set of hardware for > 10 km remote data acquisition with the ability to make large area scans rapidly using single shot data. We used the old style 8 nozzle liquid pneumatic spray vessels built and operated by Dugway personnel. These systems were fed at Stan Mumford's request with a dilute solutions of 0.2 % by mass of BG spores that produced the required 1-3 micron aerosols and operated for nearly an hour with a liter of solution from one or two nozzles. In September 1986 we completed trials at DPG giving very high signal to background (N2 Raman) from single shot data. The simultaneous elastic data showed an extremely tiny Mie scatter on top of the Rayleigh signal because the particle densities were extremely low. Later DPG analysis of the in situ aerosol particle sizer, aerosol bubbler, and wheel collector titer showed we were observing clouds of 85 to 550 particles per liter having 14 cells per particle. Eventually with signal averaging this system was improved upon to give excellent long-range performance with similar clouds providing a Signal / Background of > 500 from 3 seconds of data at 12.5 km range. Additional data from the Lidar data will be presented that give the measured cross sections and the measured atmospheric transmission.

Conclusions: Molecular absorptions must be excited through accessible windows in the atmosphere to obtain long-range performance. Additionally since signal averaging only increases the gain by a factor less than the square root of the number of shots a Lidar with low or insufficient energy can never regain the signal by averaging a large number of low energy shots. With the recent difficulties with tested solid-state systems Excimer Lidars should be revisited in light of their ease of use and successful airborne Deployment.

Abstract Oral Presentation Category- Ultraviolet Laser Induced Fluorescence Biological Detector System